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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/524,753	07/28/2005	Tomas Ussing	PLoug42.001APC	6900

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EXAMINER

ITALIANO, ROCCO

ART UNIT	PAPER NUMBER
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3746

NOTIFICATION DATE	DELIVERY MODE
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06/26/2008

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/524,753	Applicant(s) USSING, TOMAS	
	Examiner ROCCO ITALIANO	Art Unit 3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02/15/2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 140-171 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 140-171 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02/15/2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>09/15/2006</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "thermopile element" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 154-155, 157, 159, and 164-169 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In regards to claim 159 it is unclear as to the limitations in which the applicant is intending to claim by stating "micro system, a valve system and a thermal reactor system." It is indefinite as to the specific components comprising each individual system.

In regards to claim 164 it is unclear as to which "system" the applicant is referring to.

Claim 154 recites the limitation "the energy density and/or irradiation period" in lines 1-2 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claim 157 recites the limitation "the boundary surface area" in line 5. There is insufficient antecedent basis for this limitation in the claim.

Claim 166 recites the limitation "the optical energy" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim.

Claims 155, 164-169 are also rejected due to their dependence on claims rejected under 35 U.S.C. 112.

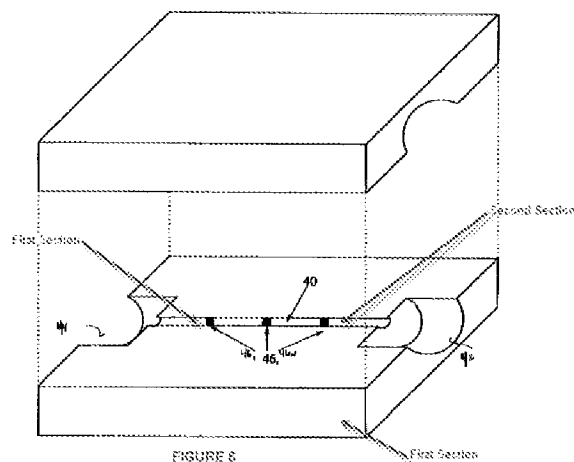
Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

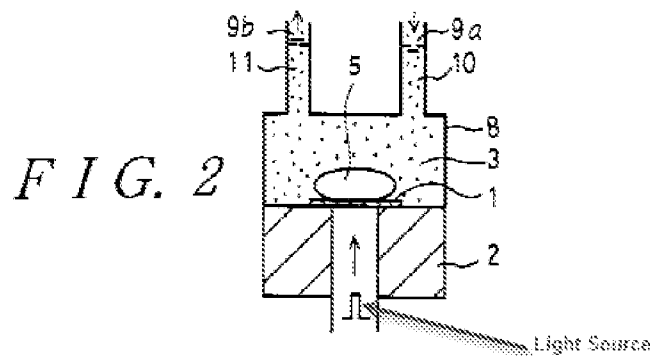
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 140-148, 150-156 and 158-171 are rejected under 35 U.S.C. 103(a) as being unpatentable over Prosperetti et al. U.S. 2001/0010799 A1 further in view of Shiraishi U.S. 6,071,081 and Suzuki U.S. 4,795,243.

In regards to claims 140, 156, 158, 160, 166, 169 and 170 Prosperetti et al. discloses a micro-pump system for generating a liquid flow in at least one micro channel (40) holding a liquid comprising: a substrate (see Fig. 6 labeled by the examiner for clarity) holding at least one micro channel (40) with at a first section having a first surface part and at least a second section having a second surface part (see Fig. 6 labeled by the examiner for clarity).

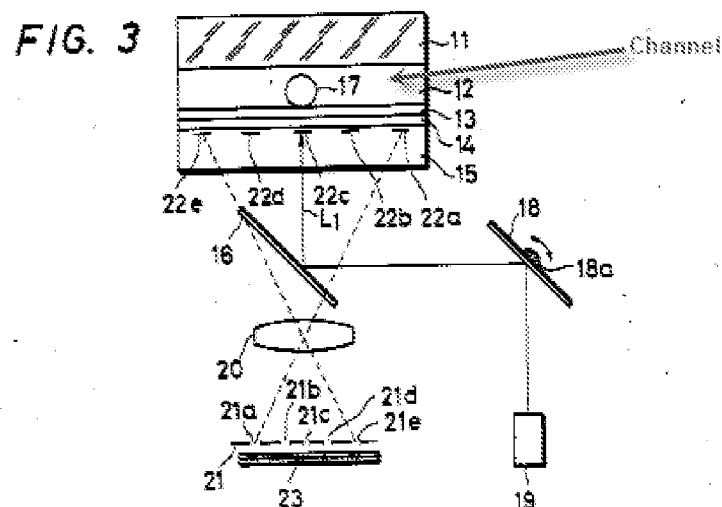


Prosperetti et al. differs from the claimed invention in that no detail is provided with respect to a light source adapted to emit a light beam and moving means for introducing a relative movement between the light beam and the substrate. Prosperetti et al. discloses heaters (46) as a means for producing a vapor bubble. However, Shiraishi teaches on analogous liquid transport device in which a light source adapted to emit a laser beam is used as a heat source in order to produce at least one vapor bubble (5) (see column 3, lines 35-40 and Fig. 2).



Shiraishi provides no explicit detail in regards to inducing a means for movement between the light/laser beam and the substrate. However, Suzuki teaches of an analogous apparatus having a light source (19), detailed as a laser, adapted to emit a light beam (L1) and a moving means (16, 18 and 18a) for inducing a relative movement between the light beam (L1) and a substrate (15). Suzuki teaches that the means for moving being adapted to move between at least a first position in which the light beam will irradiate the first surface (22c) part and a second position in which the light beam will irradiate the second surface part (22c) whereby at least one vapor bubble (17) is formed acting on the liquid (12) in the first and second section of a channel (see Fig. 3 labeled by the examiner for clarity). It would have been obvious to one of ordinary skill

in the art at the time of the invention to modify the disclosure according to Prosperetti et al. with the teaching of Shiraishi in order to obtain a micro pump in which an alternative means it utilized to form a vapor bubble by substituting the heater element (46) according to Prosperetti et al., with the light source as described by Shiraishi and further to incorporate a moving means (16, 18 and 18a) as taught by Suzuki to provide means for irradiating multiple section within a channel.



In regards to 141 and 161 Suzuki teaches that the light beam (L1) is continuously irradiating the channel when moving from a first position to a second position creating travel of at least one vapor bubble (17) from a first section (22c) to a second section (22b) (see column 4, lines 40-51 and Fig. 3).

With respect to claim 142 and further in consideration to claims 158, 160, 162 and 170, Prosperetti et al. discloses a system in which at least a first vapor bubble is formed at a first surface (461) and that at least a second bubble is formed at a second surface (462) in response to the power supplied at heaters (46) and not due to

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irradiation of a light beam. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the disclosure according to Prosperetti et al. by substituting the heater(s) (46) with the irradiating light beam according to Shiraishi in order to obtain a micro pump in which an alternative means it utilized to form a vapor bubble.

In regards to 143, 154, 155, 158, 163 and further in consideration to claim 170, Prosperetti et al. discloses that at least a second vapor bubble is formed before the at least first vapor bubble is collapsed (see paragraph 50 and Fig. 5). Prosperetti et al. disclosed further that as a new bubble grows, the remaining bubble effectively blocks or restricts the channel. In particular regards to claim 154, by the disclosure according to Prosperetti et al. describing that a bubble effectively restricts the channel, it is understood that the formation of the vapor bubble would then include dimensions corresponding to the channel dimensions in which it is formed.

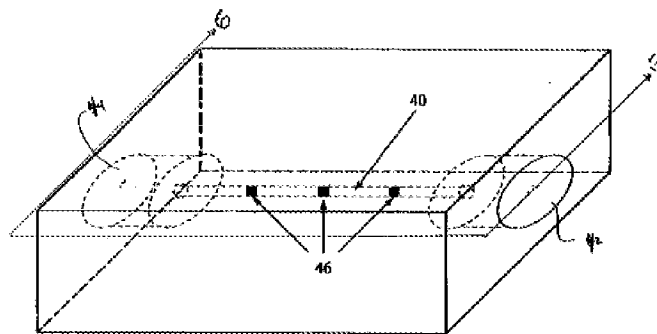


FIGURE 5

In regards to claim 144 and 165 Suzuki teaches at least one surface part of the channel comprises a light absorbing material (14) for absorption of energy. In regards to claim 145 and 146 Suzuki teaches a light beam control (18a). It would have been obvious to one of ordinary skill in the art to utilize these teaching according to Suzuki to

modify the disclosure of Prosperetti et al in view of Shiraishi in order to obtain anticipated results.

With respect to claim 147 and 148 Prosperetti et al. further in view of Shiraishi and Suzuki discloses the claimed invention however does not explicitly provide detail in regards to the energy density of the light beam. It would have been obvious to one having ordinary skill in the art at the time of the invention was made to select a light beam with a desired energy density, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

In further regards to Claim 147 and 148, Shiraishi teaches film boiling and the use of a light beam (Fig. 2) with a particular energy density in order to form a vapor bubble (5). It is understood that since film boiling takes place, the light beam has an energy density to heat at least a part of the liquid, surrounding the vapor bubble (5), to a temperature below the boiling point of the liquid (3) since no vapor bubbles are formed in this area.

In regards to claim 152 and 170 Suzuki teaches a means for moving the light beam (L1) in relation to the substrate (15) which includes a means (18a) for moving the light beam (L1). In regards to claims 150, 151 and in further consideration to claim 170, Suzuki does not provide any specific detail with respect to the means for moving the light beam in relation to the substrate comprising a means for moving the substrate or by moving the light source. However, with the teaching provided by Suzuki of moving

the light beam (L1) in relation to the substrate, it would have been obvious to one of ordinary skill in the art at the time of the invention to move the substrate or the light source as an alternative means for moving the light beam (L1) in relation to the substrate.

With respect to claim 153 and 168 Suzuki teaches of a focusing means (20) for focusing a light beam at a selected location. It is used in relation to light source (23), however it would be obvious to one of ordinary skill in the art to utilize such a focusing means (20) with any light source/light beam, as taught by Shiraishi, for focusing at a selected location.

In regards to claim 164 Prosperetti et al. discloses a system which provides for a bi-directional flow (see paragraph 49 and Fig. 4).

With respect to claim 167 Prosperetti et al does not provide disclosure in regards to the particular method of "film boiling". However, Shiraishi explicitly teaches that a vapor bubble is formed via the method of film boiling at least a part of liquid (3) in response to light beam irradiation (see abstract and Fig. 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the method of film boiling liquid in order to form a vapor bubble.

Claim 149 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prosperetti et al. U.S. 2001/0010799 A1 in view of Shiraishi U.S. 6,071,081 and Suzuki U.S. 4,795,243 as applied to the claims on which 149 depends, and further in view of Wiedemann U.S. 4,159,427.

In consideration to claim 149, the disclosure of Prosperetti et al. in view of Shiraishi and Suzuki provide no explicit detail with regards to the presence of a thermopile element or infrared detector for determining liquid temperature. It would have been obvious to one of ordinary skill in the art to select such an element/sensor/detector from a finite number of choices which would best suit the working environment in order to determine the temperature of the working fluid. The claim is obvious because a person has good reason to pursue the known options within his or her technical grasp. If such a selection leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. Evidence showing an analogous arrangement can be seen in the teachings provided by Wiedemann who teaches the use of a thermopile element (78) or infrared detector/sensor in order to determine the temperature of a liquid (see column 15, lines 18-20).

Claim 157 is rejected under 35 U.S.C. 103(a) as being unpatentable over Prosperetti et al. U.S. 2001/0010799 A1 in view of Shiraishi U.S. 6,071,081 and Suzuki U.S. 4,795,243 as applied to claim 140 above, and further in view of Schembri U.S. 6,189,659 B1.

With respect to 157, the disclosure of Prosperetti et al. in view of Shiraishi and Suzuki provide no explicit detail in regards to a first and second liquid wherein a vapor bubble is formed in the first liquid increasing a boundary surface area between the first and second liquid. However Schembri teaches of an analogous apparatus for mixing a

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fluid, containing a plurality of components, retained within a chamber/channel so as to provide a film of fluid. The apparatus comprises of a means for forming vapor bubbles within the fluid film, whereby, as each bubble is formed, the fluid is displaced resulting in mixing of the fluid. It is understood that with the formation of a bubble the surface area of the liquid is ultimately increased (see column 2 line 36 – column 3 line 8). It would have been obvious at the time of the invention to modify the invention as disclosed by Prosperetti et al. in view of Shiraishi and Suzuki with the teaching of Schembri in order to obtain a pump capable of mixing fluid within a channel by the formation of a vapor bubble via a light beam.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROCCO ITALIANO whose telephone number is (571)270-3761. The examiner can normally be reached on Mon - Fri (Alt Fri Off) 9-5 EST..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Devon C. Kramer can be reached on (571) 272-7118. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Devon C Kramer/
Supervisory Patent Examiner, Art
Unit 3746

R.I.
06/17/2008